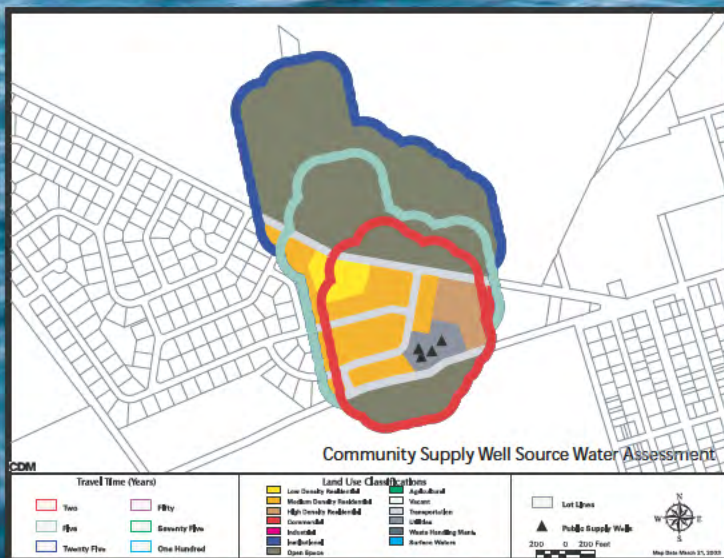
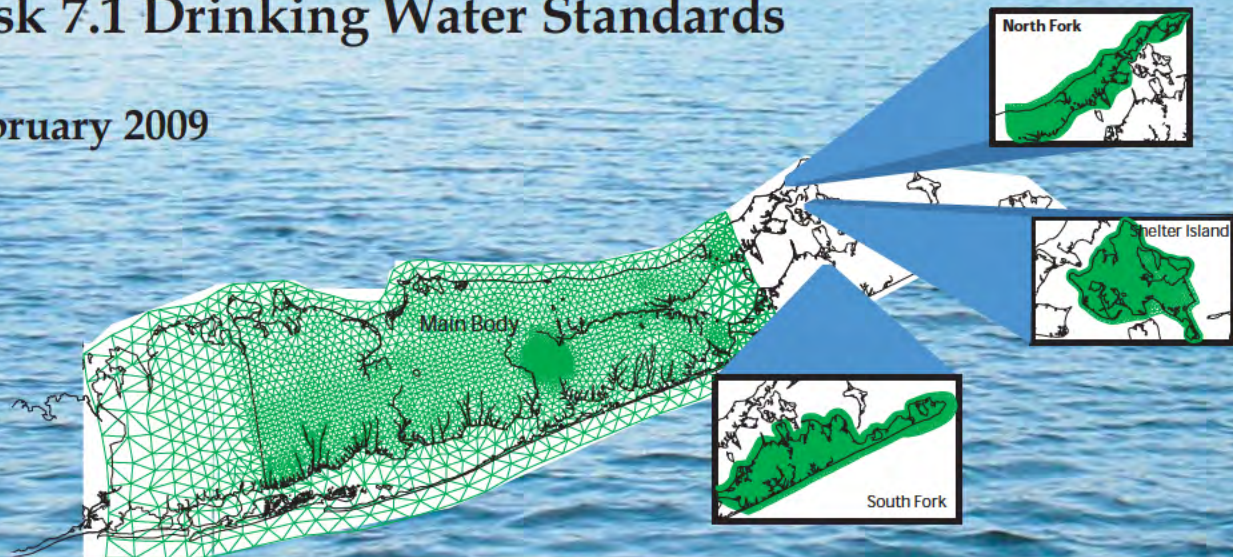


Exhibit B

Comprehensive Water Resources Management Plan for Suffolk County

Task 7.1 Drinking Water Standards

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SCWA has been sampling for TBA at all supply wells since 2002 and has only detected TBA in one upper glacial supply well. The raw water sample from this well showed 5.9 ppb of TBA in August 2005 and was removed from service (SCWA, 2006). The corresponding MTBE concentration was 0.8 ppb.

Since TBA is toxic, is highly mobile in groundwater and is difficult to treat, it is recommended that quarterly sampling for TBA be continued by SCWA and should be conducted by other purveyors, at least at those wells that show detectable MTBE or have gasoline facilities in their contributing area. Occurrence data collected via routine monitoring should be compiled and reviewed so that the need to develop a drinking water standard can be considered.

After a portion of the Suffolk County MTBE lawsuit was settled in 2008, Suffolk County expected to receive a \$1.4 million damages award. The amount and quality of SCDHS water quality monitoring data was key to forcing the settlement. MTBE monitoring and investigations will continue to be required indefinitely as the 2004 New York State ban allows MTBE concentrations of up to 0.5% by volume in gasoline as *de minimus*. The settlement award to Suffolk County should be utilized to support continuing efforts to identify MTBE and TBA occurrence and pollution sources by SCDHS.

Table 19
Physical Properties of Various Volatile Organic Compounds

Chemical	Vapor Density (g/L)	Specific Gravity	Solubility (mg/L)	Vapor Pressure (mm Hg)	Henry's Constant (unitless)	Log K _{oc}
Trichloroethylene (TCE)	5.37	1.46	1,100	77	0.422	2.6
1,1,1-Trichloroethane (TCA)	5.45	1.34	1,360	96	0.70	2.85
1,2-Dichloroethane (DCA)	4.05	1.24	8,718	79	0.04	1.2
MTBE	3.61	0.741	49,000	250	0.055	1.1
Benzene	3.19	0.879	1,780	86	0.22	1.8
1,4-Dioxane	3.03	1.03	Miscible	37	0.0002	1.23
TBA	2.55	0.786	Miscible	41	0.00049	0
Ethanol	1.59	0.789	Miscible	53	0.00024	0.71

Source: Moyer and Sloan, 2006; Mohr, 2001; Mass DEP.

4.6.3 1,4-dioxane

1,4-dioxane, commonly referred to as dioxane, has been used as a stabilizer in chlorinated solvents since the 1960s (Stanisewski, 2004). Dioxane is commonly used to prevent the breakdown of 1,1,1-trichloroethane (TCA) and trichloroethene. It is primarily found in solvents, but is also found in shampoos, liquid/dishwashing soap, and other cosmetic

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products (OCWD, 2006). Nationwide, dioxane is being detected in groundwater more frequently, particularly in association with TCA plumes. Dioxane is not readily biodegradable, but can be removed from groundwater using advanced oxidation (UV with hydrogen peroxide or ozone).

Dioxane has very similar properties to TBA in the subsurface (see Table 20). Therefore, it is very mobile (high solubility, low K_{oc}) and does not readily volatilize in groundwater (very low Henry's Constant). As mentioned above, dioxane is typically associated with TCA. However, it is more difficult to treat than TCA due to its low volatility and affinity for carbon.

Although dioxane is classified as a probable human carcinogen by USEPA, (USEPA, 2006), the USEPA has not established a drinking water standard. Several states have issued guidance or action levels for 1,4-dioxane (Table 23). Although New York State has not set a drinking water standard for dioxane specifically, listing dioxane as an "unspecified organic compound" applies a drinking water standard of 50 ppb.

Since 2003, SCWA has sampled for 1,4-dioxane at various community supply wells that contain VOCs. Between 2004 and 2006, 39 wells were sampled and analyzed for 1,4-dioxane. Of those 39 wells, 18 (46 percent) showed detectable concentrations of dioxane, all of which also contained concentrations of TCA (SCWA, unpublished water quality data). The maximum concentration of dioxane was 3.5 ppb, well below the New York State "unspecified organic" drinking water standard of 50 ppb but slightly greater than the Action Level of 3 ppb established by California, and the Guidance Level of 3 established by Massachusetts and Michigan.

Table 20
Guidance Levels for 1,4-Dioxane

State	Concentration (ppb)	Type
California	3	Action Level
Connecticut	20	Guidance Level
Florida	5	Guidance Level
Maine	70	Guidance Level
Massachusetts	3	Guidance Level
Michigan	3	Guidance Level
North Carolina	7	Guidance Level
USEPA-New England	6.1	Risk-based screening level
World Health Organization	50	Guidance Level (proposed)

Source: Connecticut Department of Public Health, 2005.

As 1,4-dioxane is classified as a probable human carcinogen by USEPA, sampling for dioxane by SCWA and other major purveyors should continue. Sampling should be conducted at a limited set of wells, particularly those with frequent detections of TCA. Initial sampling by

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purveyors who do not currently sample for dioxane should coordinate with SCDHS to determine which set of wells would be appropriate. Wells containing the highest concentrations of TCA (if applicable) should be sampled initially; occurrence data should be reviewed to assess the need to establish an MCL.

4.6.4 Glycolic Compounds

Glycols, anti-freeze and de-icing chemicals, have also been identified as a potential threat to groundwater. These chemicals are primarily composed of ethylene glycol and/or propylene glycol. Ethylene glycol is a colorless, odorless liquid that is used in antifreeze, de-icing fluid, polyester, and in paint, ink, and brake fluid (NHDES, 2006). Propylene glycol is used in de-icing fluids and polyester. Ethylene glycol is toxic if ingested in very large quantities and can cause damage to the central nervous system and kidneys (USEPA, 2006). Propylene glycol is much less toxic than ethylene glycol. USEPA has not classified either ethylene glycol or propylene glycol as a carcinogen. Currently, there is no evidence to suggest that either ethylene glycol or propylene glycol causes cancer from occupational exposure in humans (NHDES, 2006).

The release of ethylene glycol into the environment is widespread, primarily due to the improper disposal of antifreeze and de-icing fluids. Although it readily leaches to groundwater, it readily biodegrades and has a half-life in groundwater of between 2 and 48 days (NHDES, 2006). Ethylene glycol has a low vapor pressure, is miscible in groundwater and is not expected to volatilize. There is a higher risk of release of ethylene glycol and propylene glycol to surface water bodies due to storm water runoff from aircraft de-icing activities.

MCLs have not been established for either ethylene glycol or propylene glycol by USEPA. However, for kidney toxicity, USEPA has established a reference dose of 2 mg/kg/day for ethylene glycol (USEPA, 2006). Using equation 1, this reference dose corresponds to a drinking water equivalent level of 70 mg/L. USEPA has also established a lifetime health advisory of 14 mg/L (USEPA, 2004). This advisory level has also been adopted as a health advisory and/or drinking water guideline by California and Massachusetts. Other states including New Hampshire, South Dakota, and Wisconsin have set a drinking water guideline of 7 mg/L for ethylene glycol. For propylene glycol, New Hampshire and Wisconsin have set health advisories/drinking water guidelines of 30 and 25 mg/L, respectively. USEPA has not established any health advisories for propylene glycol. Although New York State has not established specific health advisories or a drinking water standard for ethylene glycol, applying the "unspecified organic contaminant" classification to ethylene glycol assigns a maximum contaminant level of 50 ug/L. A maximum contaminant level of 1 mg/L for propylene glycol has been established.

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Both ethylene glycol and propylene glycol are monitored by SCWA and were not detected in any sample collected in 2005. Since sampling for glycolic compounds is currently being conducted by SCWA, no further monitoring is recommended at this time. Should ethylene glycol and/or propylene glycol be detected with some regularity, sampling should extend to other large purveyors, particularly at shallow wells with relatively short travel times.

4.6.5 Phenolic Surfactants

Phenolic surfactants are used in a variety of industrial and domestic detergents and are commonly found in wastewater. Besides detergents, alkylphenol ethoxylates (APEs) have been used as surfactants or cleaning agents for over 50 years in several industries including textiles, paints, adhesives, pulp and paper and protective coatings (APERC, 2001). Alkylphenol ethoxylates are derived primarily from nonylphenol and octylphenol. Although municipal wastewater treatment plant discharges are the primary source of phenolic surfactants to the environment, studies have also shown that septic systems may be a significant source of APEs to groundwater (Rudel et al, 1998).

Research has been conducted on the environmental fate of APEs since they break down to form nonylphenol and octylphenol, which mimic estrogen and may act as endocrine disruptors to aquatic life. In addition to the potential for phenolic surfactants to break down to endocrine disruptors, surfactants may in fact increase the solubility of other organic compounds in soil or wastewater effluent (Venhuis and Mehrvar, 2004).

Very little data is available in the literature regarding the fate and transport of APEs in groundwater, although a fair amount of research has been and is currently being conducted on the fate of endocrine disruptor compounds in surface water (see Section 4.5 above), including nonylphenol and octylphenol. APE metabolites have high Kow values, indicating that they will effectively sorb onto sediments (Ying et al, 2002).

There are currently no drinking water standards for phenolic surfactants. USEPA has recently issued water quality criteria for nonylphenol to protect aquatic life which will be incorporated into state surface water quality standards (USEPA, 2006). A recent study by the Alkylphenols and Ethoxylates Research Council (APERC) collected water samples from 40 states between 1989 and 2004 and analyzed them for nonylphenol (APERC, 2006). The results indicate that less than 0.5 percent of the 1,255 samples exceeded the USEPA chronic fresh water concentration of 6.6 ppb for nonylphenol. USEPA is developing a Safer Detergents Stewardship Initiative (SDSI) in which industry and others are urged not to use detergents and other products containing nonylphenol ethoxylate surfactants which break down to nonylphenol.

Phenolic surfactants are a subset of the PPCPs described above in Section 4.5; on-going occurrence and health effects studies and research conducted elsewhere should be monitored

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by SCHDS, and the PEHL should continue to support the development of an occurrence database by continued monitoring and analysis.

4.6.6 Propane

SCDHS has detected propane, a commonly used fuel, in one private well, two non-community wells and one community supply well since 2004, at levels ranging from 2 to 48 ppb. In addition, propane concentrations at levels up to 3,000 were identified within a plume that may have originated from one of several large abandoned underground propane tanks. Despite its wide use, propane has not been widely detected throughout the County. It is highly degradable, and the need for increased regulation has not been identified at this time.

5.0 Results and Conclusions

Based upon available data, several recommendations are offered with respect to the potential establishment of new drinking water quality standards, and the continued collection of occurrence data by SCDHS to protect public health and support the future development of new MCLs as appropriate.

- Current information indicates that the USEPA has declined to regulate perchlorate. Because perchlorate is sufficiently prevalent in the aquifer system, NYSDOH establishment of an MCL is warranted, and New York's drinking water planning level of 5 µg/L and the action level of 18 µg/L should be re-evaluated. Should NYSDOH choose to not regulate perchlorate, Suffolk County should evaluate the technical feasibility of regulating the contaminant in public water supplies.
- SCDHS should address PPCPs, including phenolic surfactants, via a plan that includes:
 - An approach to monitor on-going occurrence and health effect studies and research elsewhere;
 - Continued groundwater monitoring and analysis by the PEHL and documentation of detections, to supplement the existing SCDHS database. Focused monitoring, particularly in areas downgradient of potential sources such as laundromats, hospitals and nursing homes could be useful.
- Although formaldehyde does not appear to be a major concern in Suffolk County since case studies around the world have shown it to degrade very rapidly in the subsurface, formaldehyde occurrence data should be reviewed and evaluated to assess whether development of an MCL is necessary.

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- SCWA is already sampling for TBA and has only shown one well to test positive since 2002; occurrence data collected via routine monitoring should be compiled and reviewed so that the need to develop a drinking water standard can be considered. New York State has adopted an MCL for MTBE. Suffolk County is expected to receive a \$1.4 million damages award from the portion of the Suffolk County MTBE lawsuit settled in 2008. The amount and quality of SCDHS water quality monitoring data was key to forcing this settlement. MTBE monitoring and investigations will continue to be required indefinitely, as the 2004 New York State ban allows MTBE concentrations of up to 0.5 percent by volume in gasoline as *de minimus*. The settlement award to the County should be utilized to support SCDHS' continuing efforts to identify MTBE and TBA occurrence and pollution sources.
- 1,4-dioxane has been detected in targeted sampling in almost 50 percent of the samples that were analyzed by SCWA since 2003. As 1,4-dioxane is classified as a probable human carcinogen by USEPA, sampling for dioxane by SCWA and other major purveyors should continue. Sampling should be conducted at a limited set of wells, particularly those with frequent detections of TCA. Initial sampling by purveyors who do not currently sample for dioxane should coordinate with SCDHS to determine which set of wells would be appropriate. Wells containing the highest concentrations of TCA should be sampled initially; occurrence data should be reviewed to assess the need to establish a contaminant-specific MCL.
- In addition, as ethanol is becoming more widely used in Suffolk County due to the MTBE ban in New York State, Suffolk County should begin to collect occurrence data for ethanol. Currently, Suffolk County is using E10, or 10 percent ethanol blended with 90 percent unleaded gasoline. However, E85 (85 percent ethanol, 15 percent unleaded gasoline) is becoming more widespread and may be used in Suffolk County in the near future. Monitoring for ethanol may be required should E85 be used in wider distribution in the future. Ethanol has a very high solubility and the lack of retardation or volatilization in groundwater make ethanol a concern.
- The SCDHS Pesticide Monitoring Program has developed an unsurpassed accounting of pesticide-related chemicals in drinking water wells and groundwater. MCLs have been needed for nearly three decades for aldicarb sulfoxide and aldicarb sulfone. The dacthal (DCPA di-acid) degradate tetrachloroterephthalic acid similarly continues to be detected in concentrations greater than the UOC standard and requires a specific MCL. Other frequently detected pesticide chemicals that are now regulated only as UOCs and that occur in significant concentrations should be considered by federal and state regulators for establishment of MCLs including: metolachlor ESA, metolachlor OA, alachlor ESA, alachlor OA, metalaxyl and imidacloprid.

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- Monitoring studies by SCDHS indicate on-going detections of DEET and MBAS in drinking water wells and groundwater monitoring wells. Specific MCLs should be considered by federal and state regulators.
- Based on available information and existing analytical protocols, no basis exists to recommend establishment of standards for phenolic surfactants at this time; however it is recommended that the County continue to remain abreast of on-going research, particularly with respect to PPACs.

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